6560-50-P

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 141

[EPA-HQ-OW-2021-0079; FRL 10022-49-OW]

Expedited Approval of Alternative Test Procedures for the Analysis of Contaminants under the Safe Drinking Water Act; Analysis and Sampling Procedures

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: This action announces the Environmental Protection Agency's (EPA) approval of alternative testing methods for use in measuring the levels of contaminants in drinking water to determine compliance with national primary drinking water regulations. The Safe Drinking Water Act authorizes EPA to approve the use of alternative testing methods through publication in the *Federal Register*. EPA is using this streamlined authority to make 17 additional methods available for analyzing drinking water samples. This expedited approach provides public water systems, laboratories, and primacy agencies with more timely access to new measurement techniques and greater flexibility in the selection of analytical methods, thereby reducing monitoring costs while maintaining public health protection.

DATES: This action is effective [**INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER**].

ADDRESSES: EPA has established a docket for this action under Docket ID No. EPA-HQ-OW-2021-0079. All documents in the docket are listed on the https://www.regulations.gov website. Although listed in the index, some information is not publicly available, e.g., confidential business information (CBI) or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed on the Internet and will be publicly available only in hard copy form. Publicly available docket

materials are available electronically through https://www.regulations.gov.

FOR FURTHER INFORMATION CONTACT: Glynda Smith, Technical Support Center, Standards and Risk Management Division, Office of Ground Water and Drinking Water (MS 140), Environmental Protection Agency, 26 West Martin Luther King Drive, Cincinnati, Ohio 45268; telephone number: (513) 569-7652; e-mail address: smith.glynda@epa.gov.

SUPPLEMENTARY INFORMATION:

I. General Information

A. *Does this Action Apply to Me?*

Public water systems are the regulated entities required to measure contaminants in drinking water samples. In addition, EPA Regions as well as State and Tribal governments with authority to administer the regulatory program for public water systems under the Safe Drinking Water Act (SDWA) may measure contaminants in water samples. When EPA sets a monitoring requirement in its national primary drinking water regulations for a given contaminant, the Agency also establishes (in the regulations) standardized test procedures for analysis of the contaminant. This action makes alternative testing methods available for particular drinking water contaminants beyond the testing methods currently established in the regulations. Drinking water systems, in consultation with the laboratories that support their compliance monitoring, may choose to use a test procedure established in the existing regulations, an alternative testing method that was approved in prior expedited approval actions, or an alternative method approved in this action. Categories and entities that may ultimately be affected by this action include:

Category	Examples of potentially regulated entities	NAICS[1]
State, local, & tribal governments	State, local and tribal governments that analyze water samples on behalf of public water systems required to conduct such analysis; state, local and tribal governments that directly operate community and non-transient non-community water systems required to monitor.	924110
Industry	Private operators of community and non-transient non-community water systems required to monitor.	221310

Municipalities	Municipal operators of community and non-transient non-community water systems required to monitor.	924110

[1]North American Industry Classification System.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be interested in this action. Other types of entities not listed in the table could also have some interest. To determine whether your facility is affected by this action, you should carefully examine the applicability language in the Code of Federal Regulations (CFR) at 40 CFR 141.2 (definition of a public water system). If you have questions regarding the applicability of this action to a particular entity, consult the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

Abbreviations and Acronyms Used in this Action

APHA: American Public Health Association

ATP: Alternate Test Procedure

CBI: Confidential Business Information

CFR: Code of Federal Regulations

DPASV: Differential Pulse Anodic Stripping Voltammetry

DPD: N,N-Diethyl-p-phenylenediamine

EPA: United States Environmental Protection Agency

GWR: Ground Water Rule

MCA: Monochloramine

MPN: Most probable number

NAICS: North American Industry Classification System

QC: Quality Control

RTCR: Revised Total Coliform Rule

SDWA: The Safe Drinking Water Act

SWTR: Surface Water Treatment Rule

SM: Standard Methods

VCSB: Voluntary Consensus Standard Bodies

II. Background

A. What is the Purpose of This Action?

In this action, EPA is approving 17 analytical methods for determining contaminant concentrations in drinking water samples collected under SDWA. Regulated entities required to sample and monitor may use either the testing methods already established in existing regulations or the alternative testing methods being approved in this action or in prior expedited approval actions. The new methods are listed along with other methods similarly approved through previous expedited actions in the *Code of Federal Regulations* (CFR) at 40 CFR part 141, appendix A to subpart C and on EPA's drinking water methods website at https://www.epa.gov/dwanalyticalmethods.

B. What is the Basis for This Action?

When EPA determines that an alternative analytical method is "equally effective" (i.e., as effective as a method that has already been promulgated in the regulations), SDWA allows EPA to approve the use of the alternative testing method through publication in the *Federal Register* (see SDWA section 1401(1)). EPA is using this streamlined approval authority to make 17 additional methods available for determining contaminant concentrations in drinking water samples collected under SDWA. EPA has determined that, for each contaminant or group of contaminants listed in Section III of this document, the additional testing methods

being approved in this action are as effective as one or more of the testing methods already approved in the regulations for those contaminants. Section 1401(1) of SDWA states that the newly approved methods "shall be treated as an alternative for public water systems to the quality control and testing procedures listed in the regulation." Accordingly, this action makes these additional 17 analytical methods legally available as options for meeting EPA's monitoring requirements.

This action does not add regulatory language, but does, for informational purposes, update an appendix to the regulations at 40 CFR part 141 that lists all methods approved under section 1401(1) of SDWA. Accordingly, while this action is not a rule, it is updating CFR text and therefore is being published in the "Final Rules" section of the *Federal Register*.

III. Summary of Approvals

EPA is approving 17 methods that are equally effective relative to methods previously promulgated in the regulations. By means of this action, these 17 methods are added to appendix A to subpart C of 40 CFR part 141.

A. Methods developed by EPA

1. EPA Method 903.0, Revision 1.0. Alpha-Emitting Radium Isotopes in Drinking Water (USEPA 2021a). EPA Method 903.0 (USEPA 1980a) was published in the drinking water regulations at 40 CFR 141.25(a) as a screening method for radium-226. The approved method describes a single-point calibration, contains no quality control specifications, and provides no calculation for the drinking water detection limit. EPA Method 903.0, Revision 1.0 was developed in response to comments from stakeholders requesting a method revision that provides clearly defined calibration and quality control criteria to assure a more robust procedure capable of yielding consistent and reliable analytical results. The methodology relative to the approved method is unchanged.

The importance of timing intervals is also discussed in the revised method. The primary interferences in radium-226 determination are due to activity contributed by radium-224 and, to a lesser degree, radium-223. Due to their short half-lives, the interferences due to radium-224 and radium-223 can be minimized if samples are held at least two weeks prior to counting.

The revised method contains detailed instructions on preparing an appropriate calibration curve based on the allowable yield range instead of relying on a single-point calibration. Alpha particle response is sensitive to the level of solid residue left in the final precipitate. A single-point calibration assumes that every sample will yield the same mass of solid precipitate. Assessing the alpha efficiency based on a yield range will improve the accuracy in the final calculated activity.

The revised method contains the quality control specifications that laboratories are expected to follow in order to obtain certification to analyze drinking water compliance samples. In addition to incorporation of specific quality control requirements and acceptance criteria, the revised method also allows the option to incorporate barium-133 as a radiochemical yield monitor. The currently approved method relies on gravimetric determination of the final barium sulfate precipitate to estimate the fractional yield of radium carried on the precipitate. Barium-133 is a non-interfering gamma emitter that is carried through the precipitation and complexation steps along with radium-226. Incorporation of a radiochemical yield monitor provides a sensitive option to assess yield based on activity instead of mass.

The revised method contains an expanded "calculations" section that includes the appropriate equation for determining the drinking water detection limit as defined in the regulations at 40 CFR 141.25(c).

EPA has determined that EPA Method 903.0, Revision 1.0 is equally effective for screening drinking water samples for radium-226, relative to the approved method. The basis for this determination is discussed in greater detail in Smith 2020b. Therefore, EPA is approving EPA Method 903.0, Revision 1.0 for determining alpha-emitting radium isotopes in drinking water. EPA Method 903.0 Rev. 1.0 is available at the National Service Center for Environmental Publications.

2. EPA Method 903.1, Revision 1.0. Radium-226 in Drinking Water Radon Emanation Technique (USEPA 2021b). EPA Method 903.1 (USEPA 1980b) was published in the drinking water regulations at 40 CFR 141.25(a) as a specific method for determination of radium-226. The approved method contains limited calibration information, no quality control specifications, no

uncertainty calculation, and provides no calculation for the drinking water detection limit. As noted previously in the discussion about EPA Method 903.0, Rev. 1.0, EPA Method 903.1, Rev. 1.0 was also developed in response to comments from stakeholders requesting a method revision with calibration and quality control criteria.

The methodology in the revised method is unchanged and involves isolating the alpha-emitting radium isotopes through selective precipitation and complexation steps. Radon-222, the progeny of radium-226, is allowed to ingrow and is then purged into an alpha scintillation cell for subsequent counting.

The revised method contains the quality control specifications that laboratories are expected to follow in order to obtain certification to analyze drinking water compliance samples. In addition to incorporation of specific quality control requirements and acceptance criteria, the revised method provides additional options for assessing yield. The currently approved method specifies a barium sulfate precipitation step to estimate the fractional yield of radium carried on the precipitate. One option in the revised method allows the incorporation of barium-133 as a radiochemical yield monitor. Barium-133 is a non-interfering gamma emitter that is carried through the procedure along with radium-226 and counted directly without requiring an additional precipitation step. Another option for determining yield on the radium-containing solution is to use atomic spectroscopy techniques.

The revised method provides expanded uncertainty calculations based on the fact that each radon-222 atom yields three short-lived alpha-emitting progeny. When half-life is short relative to the counting time, and detector efficiency is high, such as that obtained with alpha scintillation cells, there is an increased probability of observing a count not only from the parent, but also from the progeny.

The revised method also contains an expanded “calculations” section that includes the equation for determining the drinking water detection limit as defined in the regulations at 40 CFR 141.25(c).

EPA has determined that EPA Method 903.1, Revision 1.0 is equally effective for determining radium-226 in drinking water

samples, relative to the approved method. The basis for this determination is discussed in greater detail in Smith 2020c. Therefore, EPA is approving EPA Method 903.1, Revision 1.0 for the determination of radium-226 in drinking water. EPA Method 903.1 Rev. 1.0 is available at the National Service Center for Environmental Publications.

3. EPA Method 127. Determination of Monochloramine Concentration in Drinking Water (USEPA 2021c). The Surface Water Treatment Rule (SWTR) (USEPA 1989) specifies at 40 CFR 141.72(a)(4)(i) and at 40 CFR 141.72(b)(3)(i) that water systems must maintain a detectable disinfectant residual in the distribution system. The disinfectant residual can be in the form of total chlorine, combined chlorine or chlorine dioxide. In addition, 40 CFR 141.72(a)(3) and 40 CFR 141.74(b)(5) require that the residual disinfectant concentration in water entering the distribution system cannot fall below 0.2 mg/L for more than four hours. When the SWTR was promulgated, systems primarily relied on free chlorine as a secondary disinfectant to assure maintenance of a detectable residual in the distribution system. More systems have since switched to the use of chloramination in order to reduce formation of regulated disinfection byproducts. Water systems have relied on measurement of chloramines using the total chlorine N,N-diphenylenediamine (DPD) colorimetric procedure described in Standard Method 4500-Cl G-00 (APHA 2000), which is approved under the SWTR at 40 CFR 141.74(a)(2). Because the DPD reagent can react with a variety of other oxidants that may be present (e.g., organochloramines and manganese), this approach may result in an overestimation of the total chlorine residual. Organochloramines have little to no disinfection efficacy.

Disinfection based on chloramination relies on producing monochloramine (MCA), dichloramine, and nitrogen trichloride. At typical drinking water distribution system pH levels (7 – 9), MCA predominates and is more effective and stable for disinfection than dichloramine or nitrogen trichloride. While no method was available for specific MCA measurement at the time the SWTR was promulgated, such capability now exists. EPA Method 127 was developed using commercially available reagents and instrumentation. Monochloramine in the presence of a cyanoferrate catalyst reacts with a substituted phenol to form an intermediate monoimine

compound. The intermediate couples with excess substituted phenol to form a green-colored indophenol, which is proportional to the amount of monochloramine present in the sample. The indophenol can be measured using either a colorimeter or a spectrophotometer. It is not subject to the interferences observed with DPD determination and the technique is already used by water systems for (non-regulatory) process control monitoring or as part of a nitrification control plan. The method incorporates quality control specifications to assure robustness and performance.

In addition to internal studies by EPA, two public water systems (PWSs) that employ chloramination for disinfection participated in method validation studies, comparing the performance of EPA Method 127 to the performance of the approved DPD procedure. The validation study report (Alexander, Waters, and Wahman, 2020), summarizing the results from the PWSs' and EPA's studies, details the precision, accuracy, and sensitivity tests that were performed.

EPA has determined that EPA Method 127 is equally effective relative to the approved method for determining total chlorine as monochloramine in finished drinking water. The basis for this determination is discussed in greater detail in Alexander 2021. Therefore, EPA is approving EPA Method 127 for the determination of total chlorine as monochloramine in assessing both minimum disinfection residual at the entry point to the distribution system and detectable disinfectant residual within the distribution system under the SWTR. EPA Method 127 is available at the National Service Center for Environmental Publications.

B. *Methods developed by Voluntary Consensus Standard Bodies (VCSB)*

1. ASTM International. EPA compared the most recent versions of eight ASTM International methods to the earlier versions of those methods that are currently approved in 40 CFR part 141. Most of the changes in the updated versions include additional quality control specifications.

Changes between the earlier approved version and the most recent version of each method are described more fully in Smith (2020a). Besides additional quality control, the revisions involve primarily editorial changes (e.g., updated references, definitions,

terminology, procedural clarifications, and reorganization of text). The revised methods are the same as the approved versions with respect to sample collection and handling protocols, sample preparation, analytical methodology, and method performance data; thus, EPA finds they are equally effective relative to the approved methods.

EPA is thus approving the use of the following ASTM methods for the contaminants and their respective regulations listed in the following table:

ASTM Revised Version	Approved Method	Contaminant(s)	Regulation Citations
D 6919-17 (ASTM 2017a)	D 6919-03 (ASTM 2003a)	Calcium, Magnesium, Sodium	40 CFR 141.23(k)(1)
D 4327-17 (ASTM 2017b)	D4327-03 (ASTM 2003b)	Fluoride, Nitrate, Nitrite, Orthophosphate, Chloride, Sulfate	40 CFR 141.23(k)(1) 40 CFR 143.4(b)
D 3697-17 (ASTM 2017c)	D 3697-02 (ASTM 2002a)	Antimony	40 CFR 141.23(k)(1)
D 3223-17 (ASTM 2017d)	D 3223-02 (ASTM 2002b)	Mercury	40 CFR 141.23(k)(1)
D 1688 A-17 (ASTM 2017e)	D 1688 A-02 (ASTM 2002c)	Copper	40 CFR 141.23(k)(1)
D 1688 C-17 (ASTM 2017e)	D 1688 C-02 (ASTM 2002c)	Copper	40 CFR 141.23(k)(1)
D 1293-18 (ASTM 2018a)	D 1293-99 (ASTM 1999)	pH	40 CFR 141.23(k)(1)
D 3454-18 (ASTM 2018b)	D 3454-97 (ASTM 1997)	Radium-226	40 CFR 141.25(a)

The ASTM methods are available from ASTM International, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428-2959 or http://www.astm.org.

C. *Methods Developed by Vendors*

1. Bio-Rad. Simultaneous Detection of Total Coliform Bacteria and Escherichia coli Using RAPID'E. coli 2 (REC2) in Drinking Water (Bio-Rad 2020). RAPID'E. coli 2 is a membrane-filter microbiological method for the simultaneous detection of total coliforms and E. coli in drinking water by filtration of a 100 mL sample of drinking water, and infusion of the filter with a growth and indicator medium during incubation. Total coliforms and E. coli are detected as being present or absent in 100 mL samples of drinking water by enzymatic cleavage of chromogenic substances with the formation of colored compounds after incubation. Drinking water methods approved for measuring total coliforms under the Revised Total Coliform Rule (RTCR) (USEPA 2013) are listed at 40 CFR 141.852(a)(5). Methods approved for measuring E. coli in drinking water under the RTCR and under the Ground Water Rule (GWR) (USEPA 2006) are listed at 40 CFR 141.402(c)(2) and 40 CFR 141.852(a)(5), respectively. RAPID'E. coli 2 is similar to other approved drinking water methods but uses proprietary chromogens for detection of total coliforms and E. coli. These chromogens result in distinctive colors for colonies of target bacteria. RAPID'E. coli 2 is able to detect total coliforms and E. coli in 24 ± 2 hours. Reagents for RAPID'E. coli 2 are available from the manufacturer. An Alternative Test Procedure (ATP) study was conducted to compare the method performance of RAPID'E. coli 2 to the performance of two approved methods, Standard Methods 9221 B (LTB/BGLB for total coliforms) and 9221 F (LTB/EC-MUG for E. coli) (APHA 1998). The comparison study involved analyses of 200 drinking water samples – 20 replicate samples that were inoculated with very low densities of chlorine-stressed total coliforms or E. coli obtained from 10 geographically dispersed waste waters. Method specificity was evaluated using an approximately 50:50 array of positive and negative cultures (as measured by RAPID'E. coli 2), transferring these cultures to the reference methods, and observing the reaction on the reference media. The ATP validation study report (Bio-Rad, 2019) details the study design and method data evaluation. EPA has determined that RAPID'E. coli 2 is equally effective relative to the approved Standard Method 9221 B for total coliforms under the RTCR, and Standard Method 9221 F for E. coli under the RTCR and GWR. The basis for this determination is discussed in Sinclair (2019). Therefore, EPA is approving the RAPID'E. coli 2 method for determining total coliforms and E. coli in

drinking water.

A copy of the RAPID'E. coli 2 method is available from Bio-Rad Laboratories, 2000 Nobel Drive, Hercules, California 94547.

2. Maine Health Environmental Testing Laboratory (HETL). ME 531, Version 1.0. Measurement of N-Methylcarbamoyloximes and N-Methylcarbamates in Drinking Water by LC-MS/MS (Maine HETL 2019a). ME 531 is a method for the measurement of carbofuran and oxamyl in drinking water by liquid chromatography tandem mass spectrometry (LC-MS/MS). In this method, an aliquot from a preserved drinking water sample is injected into a LC system coupled to a triple quadrupole mass spectrometer. Chromatographic separation is achieved through use of an appropriate liquid chromatography analytical column and detection is achieved by operating a triple quadrupole mass spectrometer in MS/MS mode. Quantitation is determined by comparing measured response to a calibration curve generated with known analyte standards and the internal standard technique.

Carbofuran and oxamyl are regulated drinking water contaminants as specified at 40 CFR 141.61(c). The currently approved methods for the analysis of carbofuran and oxamyl are listed in 40 CFR 141.24(e)(1). Approved methods EPA Method 531.1 (USEPA 1995) and EPA Method 531.2 (USEPA 2001) use liquid chromatography and post-column derivatization to convert carbofuran and oxamyl to form highly fluorescent isoindoles, followed by fluorescence detection, which is sensitive but nonspecific. ME 531 reduces the amount of hazardous waste produced because it measures the contaminants directly without the need for derivatization. The method also increases efficiency of analysis time and provides more accurate results due to the higher sensitivity and specificity of LC-MS/MS in the determination of carbofuran and oxamyl in finished drinking water.

A laboratory validation study was conducted to evaluate the performance of ME 531. Multiple drinking water matrixes were used in the validation study. Precision, accuracy, and quantitation limit data were collected from the drinking water matrixes fortified with varying concentrations of carbofuran and oxamyl standards. The results are summarized in the validation study report (Maine HETL 2019b). EPA has determined that ME 531 is equally effective relative to the approved EPA Methods 531.1 and 531.2. The

basis for this determination is discussed in Adams 2020a. Therefore, EPA is approving ME 531 for the analysis for carbofuran and oxamyl in drinking water. ME 531 can be obtained from Maine Health and Environmental Testing Lab, 221 State Street, Augusta, Maine 04330.

3. Palintest. ChloroSense, Rev. 1.1. Free and Total Chlorine in Drinking Water by Amperometry using Disposable Sensors (Palintest 2020a). ChloroSense, Rev. 1.1 is a method for the determination of free available and total chlorine, including hypochlorous acid, hypochlorite ion, and undissociated chlorine, in drinking water by amperometry using pre-calibrated disposable sensors. In this method, free available chlorine reacts with 3,3',5,5' tetramethylbenzidine (TMB) and the oxidized product is electrochemically reduced at the surface of the free chlorine electrode. Free available chlorine and combined chlorine react with potassium iodide (KI) to liberate iodine. The iodine can be reduced electrochemically at the surface of the total chlorine electrode. The current that flows in each case is proportional to the amount of free available chlorine or total available chlorine. The current is converted to mg Cl/L by reference to calibration parameters stored in the instrument software.

The currently approved methods for the analysis of free and total chlorine in drinking water are listed in the regulations at 40 CFR 141.131(c)(1) and at 40 CFR 141.74(a)(2). ChloroSense Rev. 1.0 (Palintest 2009) was approved as being equally effective, relative to the approved Standard Method 4500-Cl D-00 (APHA 2000) for free and total chlorine, in the November 10, 2009 expedited methods approval action (USEPA 2009). ChloroSense, Rev. 1.1 is a modified version of ChloroSense, Rev. 1.0 that incorporates new hardware. The revision also clarifies language about method flexibility that was incorporated in Rev. 1.0. The modifications made for Rev. 1.1 did not include any changes to the analytical reagents or method chemistry.

EPA reviewed the changes that were made and has determined that ChloroSense, Rev. 1.1 is equally effective relative to the previously approved ChloroSense, Rev. 1.0. The basis for this determination is discussed in Adams 2020b. Therefore, EPA is approving ChloroSense, Rev. 1.1, for the analysis of free and total chlorine in drinking water. ChloroSense, Rev. 1.1, can be obtained

from Palintest Ltd, 400 Corporate Circle, Suite J, Golden, Colorado 80401.

4. Palintest. Method 1001, Rev. 1.1. Lead in Drinking Water by Differential Pulse Anodic Stripping Voltammetry (Palintest 2020b). Method 1001, Rev. 1.1 is a method for the determination of total recoverable lead in drinking water using differential pulse anodic stripping voltammetry (DPASV). In this method, a 50-mL aliquot of acid-preserved or acid-digested sample is neutralized with sodium hydroxide. A portion of the sample is decanted to a sample tube, buffered to pH 4, and conditioned with an excess of supporting electrolyte. A decomplexing agent is added to release lead from polyphosphate complexes. The lead in the conditioned sample is determined by DPASV, using a disposable sensor. This is achieved by concentrating the lead in the sample by plating onto the working electrode of the disposable sensor and then stripping it back into solution by raising the electrode potential. As the lead returns to solution a peak of current is detected. The peak potential identifies the metal, and the peak height is proportional to the concentration of the lead.

The currently approved methods for the analysis of total recoverable lead in drinking water are listed in 40 CFR 141.23(k)(1). Method 1001, Rev. 1.1 revises the currently approved Method 1001 (Palintest 1999) by allowing the use of new hardware, the streamlined Kemio instrumentation, which allows for the analysis of multiple contaminants. The modifications made for this method did not include any changes to the analytical reagents or method chemistry. Performance of Method 1001, Rev. 1.1. was compared with that of the approved Method 1001. The Kemio instrumentation in Method 1001, Rev.1.1 had precision and accuracy results comparable to those for instrumentation in the approved Method 1001. The Method Detection Limit (MDL) in the new method also improved from 2 µg/L to 1 µg/L using the Kemio instrumentation. EPA has determined that Method 1001, Rev. 1.1 is equally effective relative to the approved Method 1001. The basis for this determination is discussed in Adams 2020c. Therefore, EPA is approving Method 1001, Rev. 1.1 for the analysis of total recoverable lead in drinking water. Method 1001, Rev. 1.1 can be obtained from Palintest Ltd, 400 Corporate Circle, Suite J, Golden, Colorado 80401.

5. Palintest. ChlordioX Plus, Rev. 1.1. Chlorine Dioxide and Chlorite in Drinking Water by Amperometry using Disposable Sensors (Palintest 2020c). ChlordioX Plus, Rev. 1.1 is a method for the determination of chlorine dioxide and chlorite in drinking water by amperometry using pre-calibrated disposable sensors. Chlorine dioxide present in the sample can be reduced directly at the surface of the sensor. The current that flows is directly proportional to the amount of chlorine dioxide in the sample. To determine chlorite, any chlorine dioxide in the sample must be removed. This is done by degassing the sample using a degassing unit. Chlorite is determined by first adding potassium iodide (KI) to the sample at a pH where the chlorite does not react but any free or total chlorine in the sample does react to liberate iodine. The amount of iodine released is reduced at the surface of the sensor. The current that flows is directly proportional to the amount of free and total chlorine in the sample (Reading A). The sample is then acidified by the addition of dilute hydrochloric acid. The iodide then reacts with chlorite and free and combined chlorine to release iodine. The amount of iodine released is reduced at the surface of the sensor. The current that flows is directly proportional to the amount of chlorite and free and combined chlorine in the sample (Reading B). The amount of chlorite can then be calculated by subtracting Reading A from Reading B. The current is converted to mg analyte/L by reference to calibration parameters stored in the instrument software.

The currently approved methods for the analysis of chlorine dioxide in drinking water are listed at 40 CFR 141.131(c)(1) and at 40 CFR 141.74(a)(2), and the approved methods for daily monitoring of chlorite are listed in 40 CFR 141.131(b)(1). ChlordioX Plus, Rev. 1.0 (Palintest 2013) was approved as being equally effective, relative to the approved Standard Method 4500-ClO_2 E (APHA 1998) for the analysis of chlorine dioxide and chlorite in drinking water, in the June 19, 2014 expedited methods approval action (USEPA 2014). ChlordioX Plus, Rev. 1.1 is a modified version of ChlordioX Plus, Rev. 1.0, which incorporates new hardware. The revision also clarifies language about method flexibility incorporated in the previous version. The modifications made for this method did not include any changes to the analytical reagents or method chemistry.

EPA reviewed the changes that were made and has determined that ChlordioX Plus, Rev. 1.1 is equally as effective relative to

the approved ChlordioX Plus, Rev. 1.0. The basis for this determination is discussed in Adams 2020d. Therefore, EPA is approving ChlordioX Plus, Rev. 1.1 for the analysis of chlorine dioxide and daily monitoring of chlorite in drinking water. ChlordioX Plus, Rev. 1.1 can be obtained from Palintest Ltd, 400 Corporate Circle, Suite J, Golden, Colorado 80401.

6. Neogen. Modified Colitag™, Version 2.0. Modified Colitag™ Test Method for the Simultaneous Detection of Total Coliforms and *E. coli* in Water (Neogen 2020). Modified Colitag™ is a method that detects cleavage of chromogenic substrates to determine if total coliforms and *E. coli* are present in a 100-mL drinking water sample within 16 to 48 hours of incubation. The

method can be used in a most-probable-number (MPN) format, provided the sum of all the individual portions of the sample total 100 mL.

Modified Colitag™, Version 2.0 is an updated revision of Modified Colitag™ (CPI International 2009), which is approved for total coliforms and *E. coli* at 40 CFR 141.852(a)(5). Modified Colitag™ was approved in EPA's June 8, 2010 expedited methods approval action (USEPA 2010) for determining *E. coli* under the Ground Water Rule at 40 CFR 141.402(c)(2).

Modified Colitag™, Version 2.0 provides expanded procedural guidance on the use of the various most-probable-number formats, including multiple tube MPN, the MPNPlate™, and the MPNTray™ options.

EPA reviewed the revisions that were made and determined Modified Colitag™, Version 2.0 is equally effective relative to the originally-approved Modified Colitag™. The basis for this determination is discussed in Best 2020. Therefore, EPA is approving Modified Colitag™, Version 2.0 for determination of total coliforms and *E. coli* in drinking water. Modified Colitag™, Version 2.0 can be obtained from Neogen Corporation, 620 Lesher Place, Lansing, Michigan 48912.

IV. Statutory and Executive Order Reviews

As noted in Section II of this action, under the terms of SDWA section 1401(1), this streamlined method approval action is not a rule.

Accordingly, the Congressional Review Act, 5 U.S.C. 801 et seq., as added by the Small Business Regulatory Enforcement Fairness Act of 1996, does not apply because this action is not a rule for purposes of 5 U.S.C. 804(3). Similarly, this action is not subject to the Regulatory Flexibility Act because it is not subject to notice and comment requirements under the Administrative Procedure Act or any other statute. In addition, because this approval action is not a rule, but simply makes alternative testing methods available as options for monitoring under SDWA, EPA has concluded that other statutes and executive orders generally applicable to rulemaking do not apply to this approval action.

V. References

Adams, W. 2020a. Memo to the record describing basis for expedited approval of Maine Health Environmental Testing Laboratory ME 531, Version 1.0. July 2, 2020. (Available at https://www.regulations.gov; docket ID No. EPA-HQ-OW-2021-0079.)

Adams, W. 2020b. Memo to the record describing basis for expedited approval of Palintest ChloroSense, Rev. 1.1. July 9, 2020. (Available at https://www.regulations.gov; docket ID No. EPA-HQ-OW-2021-0079.)

Adams, W. 2020c. Memo to the record describing the basis for expedited approval of Palintest Method 1001, Rev. 1.1. July 9, 2020. (Available at https://www.regulations.gov; docket ID No. EPA-HQ-OW-2021-0079.)

Adams, W. 2020d. Memo to the record describing the basis for expedited approval of Palintest ChlordioX Plus, Rev. 1.1. July 9, 2020. (Available at https://www.regulations.gov; docket ID No. EPA-HQ-OW-2021-0079.)

Alexander, M. 2021. Memo to the record describing basis for expedited approval of EPA Method 127. February 1, 2021. (Available at https://www.regulations.gov; docket ID No. EPA-HQ-OW-2021-0079.)

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List of Subjects in 40 CFR Part 141

Environmental protection, Chemicals, Indians-lands, Intergovernmental relations, Reporting and recordkeeping requirements, Water supply

Jennifer L. McLain, Director,
Office of Ground Water and Drinking Water.

For the reasons stated in the preamble, the Environmental Protection Agency amends 40 CFR part 141 as follows:

PART 141—NATIONAL PRIMARY DRINKING WATER REGULATIONS

1. The authority citation for part 141 continues to read as follows:

Authority: 42 U.S.C. 300f, 300g-1, 300g-2, 300g-3, 300g-4, 300g-5, 300g-6, 300j-4, 300j-9, and 300j-11**.**

2. Amend appendix A to subpart C of part 141 as follows:

a. In the table entitled "ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 141.23(k)(1)" revising the entries for "Antimony," "Calcium," "Copper," "Fluoride," "Lead", "Magnesium," "Mercury," "Nitrate," "Nitrite," "Orthophosphate," "pH," and "Sodium" ;

b. Revise the table entitled "ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 141.24(e)(1)";

c. In the table entitled "ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 141.25(a)" revise the entry for "Radium 226";

d. Revise the table entitled "ALTERNATIVE TESTING METHODS FOR DISINFECTANT RESIDUALS LISTED AT 40 CFR 141.74(a)(2)";

e. In the table entitled "ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 141.131(b)(1)" revise the entry for "Chlorite-daily monitoring as prescribed in 40 CFR 141.132(b)(2)(i)(A)";

f. In the table entitled "ALTERNATIVE TESTING METHODS FOR DISINFECTANT RESIDUALS LISTED AT 40 CFR 141.131(c)(1)" revise the entries for "Free Chlorine," "Total Chlorine," and "Chlorine Dioxide";

g. In the table entitled "ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 141.402(c)(2)" revise the entry for "*E. coli*";

h. Revise the table entitled “ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 141.852(a)(5)”;

i. In the table entitled “ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 143.4(b)” revise the entries for “Chloride” and “Sulfate”;

j. Revise footnotes “2”, “3”, “4”, “8”, “9”, “13”, “14”, “16”, “17”, “24”, “25”, “26”, “28”, “29”, “48”, and “49”; and,

k. Add footnotes 53 through 61.

The revisions and additions read as follows:

APPENDIX A TO SUBPART C OF PART 141—ALTERNATIVE TESTING METHODS APPROVED FOR ANALYSES UNDER THE SAFE DRINKING WATER ACT

* * * * *

ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 141.23 (k)(1)

Contaminant	Methodology	EPA Method	SM 21st Edition [1]	SM 22nd Edition 28	SM 23rd Edition 49	SM Online 3	ASTM [4]	Other
* * * * * * *								
Antimony	Hydride – Atomic Absorption						D 3697-07, -12, -17	
	Atomic Absorption; Furnace		3113 B	3113 B	3113 B	3113 B-04, B-10		
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2 [2]						
* * * * * * *								

Calcium	EDTA titrimetric		3500-Ca B	3500-Ca B	3500-Ca B		D 511-09, -14 A	
	Atomic Absorption; Direct Aspiration		3111 B	3111 B	3111 B		D 511-09, -14 B	
	Inductively Coupled Plasma		3120 B	3120 B	3120 B			
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2 [2]						
	Ion Chromatography						D 6919-09, -17	
* * * * * * *								
Copper	Atomic Absorption; Furnace		3113 B	3113 B	3113 B	3113 B-04, B-10	D 1688-07, -12 C, -17 C	
	Atomic Absorption; Direct Aspiration		3111 B	3111 B	3111 B		D 1688-07, -12 A, -17 A	
	Inductively Coupled Plasma		3120 B	3120 B	3120 B			
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2 [2]						
	Colorimetry							Hach Method 8026 [35] Hach Method 10272 [36]
* * * * * * *								
Fluoride	Ion Chromatography		4110 B	4110 B	4110 B		D 4327-11, -17	
	Manual Distillation; Colorimetric SPADNS		4500-F^- B, D	4500-F^- B, D	4500-F^- B, D			

	Manual Electrode		4500-F^- C	4500-F^- C	4500-F^- C		D 1179-04, 10 B, 16 B	
	Automated Alizarin		4500-F^- E	4500-F^- E	4500-F^- E			
	Arsenite-Free Colorimetric SPADNS							Hach SPADNS 2 Method 10225 [22]
Lead	Atomic Absorption; Furnace		3113 B	3113 B	3113 B	3113 B-04, B-10	D 3559-08 D, -15 D	
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP-AES)	200.5, Revision 4.2 [2]						
	Differential Pulse Anodic Stripping Voltametry							Method 1001, Rev. 1.1 [57]
Magnesium	Atomic Absorption		3111 B	3111 B	3111 B		D 511-09, -14 B	
	Inductively Coupled Plasma		3120 B	3120 B	3120 B			
	Complexation Titrimetric Methods		3500-Mg B	3500-Mg B	3500-Mg B		D 511-09, -14 A	
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2 [2]						
	Ion Chromatography						D 6919-09, -17	
Mercury	Manual, Cold Vapor		3112 B	3112 B	3112 B	3112 B-09	D 3223-12, -17	
* * * * * * *								
Nitrate	Ion Chromatography		4110 B	4110 B	4110 B		D 4327-11, -17	
	Automated Cadmium Reduction		4500-NO_3^- F	4500-NO_3^- F	4500-NO_3^- F			

	Manual Cadmium Reduction		4500-NO_3^- E	4500-NO_3^- E	4500-NO_3^- E			
	Ion Selective Electrode		4500-NO_3^- D	4500-NO_3^- D	4500-NO_3^- D			
	Reduction/Colorimetric							Systea Easy (1-Reagent) [8] NECi Nitrate-Reductase [40]
	Colorimetric; Direct							Hach TNTplus™ 835/836 Method 10206 [23]
	Capillary Ion Electrophoresis						D 6508-15	
Nitrite	Ion Chromatography		4110 B	4110 B	4110 B		D 4327-11, -17	
	Automated Cadmium Reduction		4500-NO_3^- F	4500-NO_3^- F	4500-NO_3^- F			
	Manual Cadmium Reduction		4500-NO_3^- E	4500-NO_3^- E	4500-NO_3^- E			
	Spectrophotometric		4500-NO_2^- B	4500-NO_2^- B	4500-NO_2^- B			
	Reduction/Colorimetric							Systea Easy (1-Reagent) [8] NECi Nitrate-Reductase [40]
	Capillary Ion Electrophoresis						D 6508-15	
Ortho-phosphate	Ion Chromatography		4110 B	4110 B	4110 B		D 4327-11, -17	
	Colorimetric, ascorbic acid, single reagent		4500-P E	4500-P E	4500-P E	4500-P E-99		

	Colorimetric, Automated, Ascorbic Acid		4500-P F	4500-P F	4500-P F	4500-P F-99		Thermo Fisher Discrete Analyzer [41]
	Capillary Ion Electrophoresis						D 6508-15	
pH	Electrometric	150.3 [48]	4500-H^+ B	4500-H^+ B	4500-H^+ B		D 1293-12, -18	
* * * * * * *								
Sodium	Atomic Absorption; Direct Aspiration		3111 B	3111 B	3111 B			
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2 [2]						
	Ion Chromatography						D 6919-09, -17	
* * * * * * *								

ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 141.24 (e)(1)

Contaminant	Methodology	EPA Method	SM 21st Edition[1]	SM 22nd Edition [28], SM 23rd Edition [49]	SM Online [3]	Other
Benzene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
Carbon tetrachloride	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
Chlorobenzene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
1,2-Dichlorobenzene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				

1,4-Dichlorobenzene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
1,2-Dichloroethane	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
cis-Dichloroethylene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
trans-Dichloroethylene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
Dichloromethane	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
1,2-Dichloropropane	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
Ethylbenzene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
Styrene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
Tetrachloroethylene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
1,1,1-Trichloroethane	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
Trichloroethylene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
Toluene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
1,2,4-Trichlorobenzene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
1,1-Dichloroethylene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
1,1,2-Trichlorethane	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
Vinyl chloride	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
Xylenes (total)	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				
2,4-D	Gas Chromatography/Electron Capture Detection (GC/ECD)		6640 B	6640 B	6640 B-01, B-06	
2,4,5-TP (Silvex)	Gas Chromatography/Electron Capture Detection (GC/ECD)		6640 B	6640 B	6640 B-01, B-06	

Alachlor	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24]				
Atrazine	Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry (LC/ESI-MS/MS)	536 [25]				
	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24], 523 [26]				
Benzo(a)pyrene	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24]				
Carbofuran	High-performance liquid chromatography (HPLC) with post-column derivatization and fluorescence detection		6610 B	6610 B	6610 B-04	
	Liquid Chromatography/Mass Spectrometry					ME 531 [58]
Chlordane	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24]				
Dalapon	Ion Chromatography Electrospray Ionization Tandem Mass Spectrometry (IC-ESI-MS/MS)	557 [14]				
	Gas Chromatography/Electron Capture Detection (GC/ECD)		6640 B	6640 B	6640 B-01, B-06	
Di(2-ethylhexyl)adipate	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24]				
Di(2-ethylhexyl)phthalate	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24]				
Dibromochloropropane (DBCP)	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9]				
Dinoseb	Gas Chromatography/Electron Capture Detection (GC/ECD)		6640 B	6640 B	6640 B-01, B-06	

Endrin	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24]				
Ethyl dibromide (EDB)	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9]				
Glyphosate	High-Performance Liquid Chromatography (HPLC) with Post-Column Derivatization and Fluorescence Detection		6651 B	6651 B	6651 B-00, B-05	
Heptachlor	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24]				
Heptachlor Epoxide	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24]				
Hexachlorobenzene	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24]				
Hexachlorocyclo-pentadiene	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24]				
Lindane	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24]				
Methoxychlor	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24]				
Oxamyl	High-performance liquid chromatography (HPLC) with post-column derivatization and fluorescence detection		6610 B	6610 B	6610 B-04	
	Liquid Chromatography/Mass Spectrometry					ME 531 [58]
PCBs (as Aroclors)	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24]				

Pentachlorophenol	Gas Chromatography/Electron Capture Detection (GC/ECD)		6640 B	6640 B	6640 B-01, B-06	
	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24]				
Picloram	Gas Chromatography/Electron Capture Detection (GC/ECD)		6640 B	6640 B	6640 B-01, B-06	
Simazine	Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry (LC/ESI-MS/MS)	536 [25]				
	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24], 523 [26]				
Toxaphene	Solid Phase Extraction/Gas Chromatography/Mass Spectrometry (GC/MS)	525.3 [24]				
Total Trihalomethanes	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9], 524.4 [29]				

ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 141.25(a)

Contaminant	Methodology	EPA Method	SM 21st Edition [1]	SM 22nd Edition [28], SM 23rd Edition [49]	ASTM [4]	SM Online [3]
* * * * * * *						
Radium 226	Radon emanation	903.1, Rev. 1.0 [53]	7500-Ra C	7500-Ra C	D 3454-05, -18	
	Radiochemical	903.0, Rev. 1.0 [54]	7500-Ra B	7500-Ra B	D 2460-07	
	Gamma Spectrometry			7500-Ra E		7500-Ra E-07
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ALTERNATIVE TESTING METHODS FOR DISINFECTANT RESIDUALS LISTED AT 40 CFR 141.74(a)(2)

Residual	Methodology	EPA Methods	SM 21st Edition [1]	SM 22nd Edition [28], SM 23rd Edition [49]	ASTM [4]	Other
Free Chlorine	Amperometric Titration		4500-Cl D	4500-Cl D	D 1253-08, -14	
	DPD Ferrous Titrimetric		4500-Cl F	4500-Cl F		
	DPD Colorimetric		4500-Cl G	4500-Cl G		Hach Method 10260 [31]
	Indophenol Colorimetric					Hach Method 10241 [34]
	Syringaldazine (FACTS)		4500-Cl H	4500-Cl H		
	On-line Chlorine Analyzer	334.0 [16]				
	Amperometric Sensor					ChloroSense [17], ChloroSense Rev. 1.1 [59]
Total Chlorine	Amperometric Titration		4500-Cl D	4500-Cl D	D 1253-08, -14	
	Amperometric Titration (Low level measurement)		4500-Cl E	4500-Cl E		
	DPD Ferrous Titrimetric		4500-Cl F	4500-Cl F		
	DPD Colorimetric		4500-Cl G	4500-Cl G		Hach Method 10260 [31]
	Iodometric Electrode		4500-Cl I	4500-Cl I		
	On-line Chlorine Analyzer	334.0 [16]				
	Amperometric Sensor					ChloroSense [17], ChloroSense, Rev. 1.1 [59]
	Indophenol Colorimetric	127 [55]				
Chlorine Dioxide	Amperometric Titration		4500–ClO_2 C	4500–ClO_2 C		
	Amperometric Titration		4500–ClO_2 E	4500–ClO_2 E		

	Amperometric Sensor					ChlordioX Plus [32], ChlordioX Plus, Rev. 1.1 [60]
Ozone	Indigo Method		4500–O_3 B	4500–O_3 B		

ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 141.131(b)(1)

Contaminant	Methodology	EPA Method	ASTM [4]	SM Online [3]	SM 21st Edition [1]	SM 22nd Edition [28], SM 23rd Edition [49]	Other
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Chlorite – daily monitoring as prescribed in 40 CFR 141.132(b)(2)(i)(A)	Amperometric Titration				4500-ClO_2 E	4500-ClO_2 E	
	Amperometric Sensor						ChlordioX Plus [32], ChlordioX Plus, Rev. 1.1 [60]

ALTERNATIVE TESTING METHODS FOR DISINFECTANT RESIDUALS LISTED AT 40 CFR 141.131(c)(1)

Residual	Methodology	SM 21st Edition [1]	SM 22nd Edition [28], SM 23rd Edition [49]	ASTM [4]	Other
Free Chlorine	Amperometric Titration	4500-Cl D	4500-Cl D	D 1253-08, -14	
	DPD Ferrous Titrimetric	4500-Cl F	4500-Cl F		
	DPD Colorimetric	4500-Cl G	4500-Cl G		Hach Method 10260 [31]
	Indophenol Colorimetric				Hach Method 10241[34]
	Syringaldazine (FACTS)	4500-Cl H	4500-Cl H		

	Amperometric Sensor				ChloroSense [17], ChloroSense, Rev. 1.1 [59]
	On-line Chlorine Analyzer				EPA 334.0 [16]
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Total Chlorine	Amperometric Titration	4500-Cl D	4500-Cl D	D 1253-08, -14	
	Low level Amperometric Titration	4500-Cl E	4500-Cl E		
	DPD Ferrous Titrimetric	4500-Cl F	4500-Cl F		
	DPD Colorimetric	4500-Cl G	4500-Cl G		Hach Method 10260[31]
	Iodometric Electrode	4500-Cl I	4500-Cl I		
	Amperometric Sensor				ChloroSense [17], ChloroSense, Rev. 1.1 [59]
	On-line Chlorine Analyzer				EPA 334.0 [16]
Chlorine Dioxide	Amperometric Method II	4500-ClO_2 E	4500-ClO_2 E		
	Amperometric Sensor				ChlordioX Plus [32], ChlordioX Plus, Rev. 1.1 [60]

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ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 141.402(c)(2)

Organism	Methodology	SM 20th Edition [6]	SM 21st Edition[1]	SM 22nd Edition [28]	SM 23rd Edition [49]	SM Online [3]	Other
E. coli	Colilert		9223 B	9223 B	9223 B	9223 B-97, B-04	
	Colisure		9223 B	9223 B	9223 B	9223 B-97, B-04	
	Colilert-18	9223 B	9223 B	9223 B	9223 B	9223 B-97, B-04	
	Readycult®						Readycult® [20]

	Colitag						Modified Colitag™ [13], Modified Colitag™, Version 2.0 [61]
	Chromocult®						Chromocult® [21]
	EC-MUG			9221 F	9221 F	9221 F-06	
	NA-MUG				9222 I		
	m-ColiBlue24 Test				9222 J		
	Tecta EC/TC [33, 43]						
	RAPID'E.coli 2 [56]						
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ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 141.852(a)(5)

Organism	**Methodology Category**	**Method**	**SM 20th, 21st Editions [1,6]**	**SM 22nd Edition [28]**	**SM 23rd Edition [49]**	**SM Online [3]**
Total Coliforms	Lactose Fermentation Methods	Standard Total Coliform Fermentation Technique		9221 B.1, B.2	9221 B.1, B.2, B.3, B.4	9221 B.1, B.2-06
		Presence-Absence (P-A) Coliform Test			9221 D.1, D.2, D.3	
	Membrane Filtration Methods	Standard Total Coliform Membrane Filter Procedure using Endo Media			9222 B, C	
		Simultaneous Detection of Total Coliforms and *E. coli* by Dual Chromogen Membrane Filter Procedure			9222 J	

		(using mColiBlue24 medium)				
		Simultaneous Detection of Total Coliform Bacteria and *Escherichia coli* Using RAPID'*E.coli* (REC2) in Drinking Water [56]				
	Enzyme Substrate Methods	Colilert®		9223 B	9223 B	9223 B-04
		Colisure®		9223 B	9223 B	9223 B-04
		Colilert-18	9223 B	9223 B	9223 B	9223 B-04
		Tecta EC/TC [33, 43]				
		Modified Colitag™, Version 2.0 [61]				
Escherichia coli	*Escherichia coli* Procedure (following Lactose Fermentation Methods)	EC-MUG medium		9221 F.1	9221 F.1	9221 F.1-06
	Escherichia coli Partitioning Methods (following Membrane Filtration Methods)	EC broth with MUG (EC-MUG)			9222 H	
		NA-MUG medium			9222 I	
	Simultaneous Detection of Total Coliforms and *E. coli* by Dual Chromogen Membrane Filter Procedure	mColiBlue24 medium			9222 J	
	Membrane Filtration Method	Simultaneous Detection of Total Coliform Bacteria and *Escherichia coli* Using RAPID'*E.coli*				

		(REC2) in Drinking Water [56]				
	Enzyme Substrate Methods	Colilert®		9223 B	9223 B	9223 B-04
		Colisure®		9223 B	9223 B	9223 B-04
		Colilert-18	9223 B	9223 B	9223 B	9223 B-04
		Tecta EC/TC [33, 43]				
		Modified Colitag™, Version 2.0 [61]				

ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 143.4(b)

Contaminant	Methodology	EPA Method	ASTM [4]	SM 21st Edition [1]	SM 22nd Edition [28], SM 23rd Edition [49]	SM Online [3]
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Chloride	Silver Nitrate Titration		D 512-04 B, 12 B	4500-Cl^- B	4500-Cl^- B	
	Ion Chromatography		D 4327-11, -17	4110 B	4110 B	
	Potentiometric Titration			4500-Cl^- D	4500-Cl^- D	
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Sulfate	Ion Chromatography		D 4327-11, -17	4110 B	4110 B	
	Gravimetric with ignition of residue			4500-SO_4^{2-} C	4500-SO_4^{2-} C	4500-SO_4^{2-} C-97
	Gravimetric with drying of residue			4500-SO_4^{2-} D	4500-SO_4^{2-} D	4500-SO_4^{2-} D-97
	Turbidimetric method		D 516-07, 11, 16	4500-SO_4^{2-} E	4500-SO_4^{2-} E	4500-SO_4^{2-} E-97
	Automated methylthymol blue method			4500-SO_4^{2-} F	4500-SO_4^{2-} F	4500-SO_4^{2-} F-97
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[4] Available from ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or http://astm.org. The methods listed are the only alternative versions that may be used.

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[17] ChloroSense. "Measurement of Free and Total Chlorine in Drinking Water by Palintest ChloroSense," August 2009. Available at https://www.nemi.gov or from Palintest Ltd, 1455 Jamike Avenue (Suite 100), Erlanger, KY 41018.

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